A textbook for an honors linear algebra course (updated Sept. 4, 2017):

Linear Algebra Done Wrong.

by Sergei Treil

From the Introduction:

The title of the book sounds a bit mysterious. Why should anyone read this book if it presents the subject in a wrong way? What is particularly done "wrong" in the book?

Before answering these questions, let me first describe the target audience of this text. This book appeared as lecture notes for the course "Honors Linear Algebra". It supposed to be a *first* linear algebra course for mathematically advanced students. It is intended for a student who, while not yet very familiar with abstract reasoning, is willing to study more rigorous mathematics that is presented in a "cookbook style" calculus type course. Besides being a first course in linear algebra it is also supposed to be a first course introducing a student to *rigorous* proof, formal definitions---in short, to the style of modern theoretical (abstract) mathematics.
The target audience explains the very specific blend of elementary ideas and concrete examples, which are usually presented in introductory linear algebra texts with more abstract definitions and constructions typical for advanced books.

Another specific of the book is that it is not written by or for an algebraist. So, I tried to emphasize the topics that are important for analysis, geometry, probability, etc., and did not include some traditional topics. For example, I am only considering vector spaces over the fields of real or complex numbers. Linear spaces over other fields are not considered at all, since I feel time required to introduce and explain abstract fields would be better spent on some more classical topics, which will be required in other disciplines. And later, when the students study general fields in an abstract algebra course they will understand that many of the constructions studied in this book will also work for general fields.

Also, I treat only finite-dimensional spaces in this book and a basis always means a finite basis. The reason is that it is impossible to say something non-trivial about infinite-dimensional spaces without introducing convergence, norms, completeness etc., i.e. the basics of functional analysis. And this is definitely a subject for a separate course (text). So, I do not consider infinite Hamel bases here: they are not needed in most applications to analysis and geometry, and I feel they belong in an abstract algebra course.

Terms of use:

studying and/or teaching. You can print paper copies of the book or its parts using either personal printer or professional printing services.
Instructors teaching a class (or their institutions) can provide students with printed copies of the book and charge the fee to cover the cost of printing; however the students should have an option to use the free electronic version.

What is new:

September 2017 version of the book includes correction of numerous typos. Some exercises were updated.

In the September 2014 version I corrected numerous typos, noticed by the readers. I also added some more detailed explanations, in particular, clearly specifying in all situations whether real or complex case (or both) is considered.

In this version I also expanded a bit sections on non-orthogonal orthogonalization of the quadratic forms, and on singular value decomposition and its applications. In particular, I added a section about Moore--Penrose inverse (Section 4.5 in Ch. 6).

Download the book:

- Introduction and Table of Contents --- PDF, 220 K.
- Text of the book (September 4, 2017) --- PDF, 1.3 MB

If you want to see the older versions of the text, you can find it below:

- July 2015 version og the book
- September 2014 version of the book (the previous "official" version)
- July 2014 version of the book
- Introduction and Table of Contents for July 2014 version---PDF, 167K.
- Errata (changes from Juy 2011 to July 2014 version).
- July 2011 version of the book.
- Errata to June 2010 version of the book.
- June 2010 version of the book.
- Errata to January 2010 version (mistakes that vere corrected in June 2010 version).
- January 2010 version of the book.
- Previous (2009) version of the book.
- The old (2004) version of the book..

Math. Department home page	back to my home page